Paper ID: 60433
oral
student

18th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Mitigation - Tools, Techniques and Challenges (4)

Author: Ms. Bhavana K
R V College of Engineering, Bengaluru, India

Ms. Rithika Varma
R V College of Engineering, Bengaluru, India
Mr. Tejus Sankar
R V College of Engineering, Bengaluru, India

SPACE DEBRIS MITIGATION USING PHOTONIC LASER THRUST

Abstract

Space debris has become an alarming issue. Every new mission adds new hardware into space and only a few of them are successfully retrieved. In accordance with Kessler's syndrome, even if no new hardware enters the space environment, collisions between existing hardware will cause space debris to multiply. This may hinder future exploration of space and halt or damage the current programs before any profitable outcome is obtained. At this point, it is the need of the hour for debris remediation and mitigation. There are several contact and non-contact methods for space debris reduction and mitigation. The downside of contact methods are- they require highly precise navigation and manoeuvering to reach the debris. The existing non-contact methods are mostly based on drag-augmentation, usage of electrodynamic tethers, or laser ablation. There exists a high risk of collision with existing debris in the first two cases, whereas the third requires precise pointing to the debris. These aspects further increase the complexity of the problem at hand. This paper proposes a method to use photon thrust for future space debris mitigation. Photon thrust has been successfully demonstrated as a method of propulsion in laboratory by Y.K. Bae Corporation. In view of this, equipping all future spacecraft with high reflectance mirrors before their launch allows for the creation of an optical cavity in the presence of another high reflectance mirror. The said other mirror can be situated on another spacecraft launched with the sole purpose of deorbiting the former mentioned spacecraft when it is no longer in use and is essentially-debris. Consequently, the ideal type of mirrors, their alignment and the ideal distance between them for the efficient collection of photon beam in order to reduce losses considering the orbit's curvature have been discussed. This involves orbit-matching with the debris or using a higher orbit w.r.t. the debris. An estimate of the time taken to de-orbit a piece of debris is made based on calculations and appropriate simulations. The reaction of the cavity to physical changes and collision of photons with high energy atmospheric particles and its effect on photon thrust is studied. The possibility to add laser-ablation equipment to remove debris (¡10cm) is inspected. Finally, the additional equipment for orbit-manoeuvering and re-usability, and compact structure is discussed.